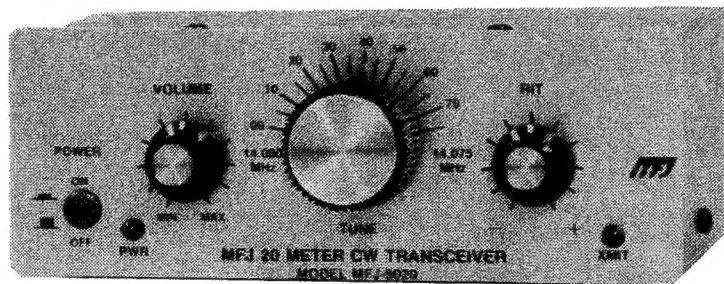




## 20 METER CW TRANSCEIVER



Model MFJ-9020

### INSTALLATION MANUAL

**CAUTION: Read All Instructions Before Operating Equipment**

# MFJ ENTERPRISES, INC.

P.O. BOX 494, MISSISSIPPI STATE, MS 39762, USA

## INTRODUCTION:

Congratulations on your choice of the MFJ-9020 20-Meter QRP transceiver. Please read this manual carefully before attempting to operate your new radio. Let's begin with an introduction to some special features we think you'll like!

**EASY TO OPERATE:** The MFJ-9020 is extremely simple to set up and operate (much easier than a complex multi-band digital radios).

**GREAT SENSITIVITY:** The new MFJ-9020 receiver is more sensitive than ever -- even the weakest signals come in loud and clear! Plus, we include four-pole front-end filter, double-balanced mixing, and careful gain distribution to knock down intermod.

**EXCELLENT SELECTIVITY:** A tight CW-bandwidth crystal filter fights unwanted QRM and noise to the max! Add our 700 HZ MFJ-726 NARROW AUDIO FILTER for even more QRM-fighting selectivity.

**SMOOTH AND STABLE VFO:** A special wide-spaced 6:1 reduction-drive VFO capacitor glides slowly across the easy-to-read linear dial. Add the convenience of true Receive Incremental Tuning (RIT), and you may forget you aren't operating a "big rig"!

**EASY ON THE EARS:** Our graceful AGC tracks only the signals you want to hear -- and NEVER locks onto adjacent signals outside the bandpass. In transmit, enjoy the crystal-clear 700 HZ sidetone (no square waves). Stop sending, and the receiver snaps back to life at full sensitivity -- thanks to our exclusive "AGC Instant Recovery Circuit" (TM). There's plenty of audio power from the built-in 3" speaker or from your headphones.

**EASY TO POWER:** No heavy power supplies to lug. The receiver draws less than 50 mA on average, and the transmitter requires only 1.2-A peak.

**RUGGED TRANSMITTER:** The MFJ-9020 delivers full QRP output, tolerates up to 3:1 VSWR, and survives momentary feedline shorts or opens. Adjustable-hold T/R switching matches your personal operating style. And, 700-HZ offset is automatic; just like on a big rig. For added fun, install the MFJ-412 CURTIS IAMBIC KEYSER MODULE and hook up your favorite set of paddles.

**GO PORTABLE:** Take your MFJ-9020 QRP station anywhere with the MFJ-1772 PORTABLE DIPOLE or matching MFJ-971 QRP TUNER. Add a MFJ-4114 PORTABLE POWER PACK, or the new super-compact MFJ-4110 AC WALL-ADAPTER power pack. The MFJ-9020 uses rugged G-10 board and is housed in a durable vinyl-clad cabinet.

These features all add up to hour after hour of operating in arm-chair comfort. Best of all, your radio is backed by MFJ's exclusive unconditional "No Matter What" 1-year guarantee!

## TECHNICAL SPECIFICATIONS:

### RECEIVER SECTION:

Frequency Coverage:	14.000-14.075 MHz
Receiver Type:	Single conversion superhet
VFO Frequency:	4 MHz
IF Frequency:	10 MHz
IF Selectivity:	CW-bandwidth crystal ladder filter
AGC:	Audio-derived, instant T/R recovery
Sensitivity:	.35 uV or better
RIT:	1 KHz range
Audio:	100-mW to speaker or headphones
Audio Filter (opt):	700-Hz 4-pole active, unity gain
Receive Current:	50 mA

### TRANSMITTER SECTION:

Keying:	High-Z, Semi-QSK
Keyer (opt)	Curtis 8044ABM Iambic
Sidetone:	700-Hz Sinewave
RF Power Output:	> 4 W, Vcc 13.8 V, 50-Ohm Load
VSWR Tolerance:	3:1 VSWR
Transmit Current:	1.2 Amp at 13.8 VDC
T/R Switch:	Semi-QSK, adjustable hold

### BLOCK DIAGRAM:

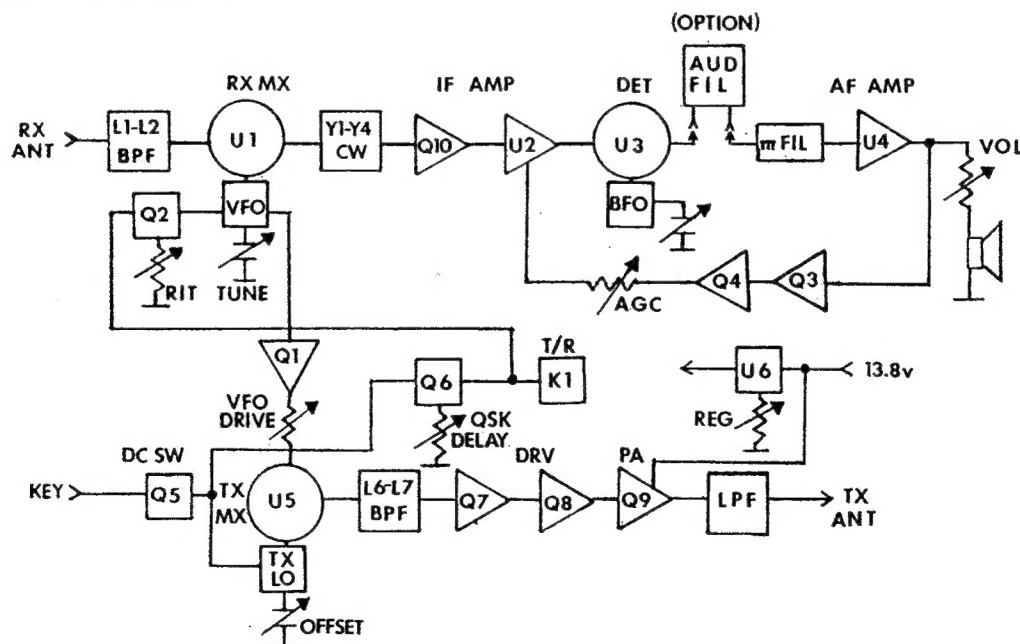


Figure 1.

## THEORY OF OPERATION:

If you are technically inclined, read this page for the "inside scoop" on your rig. Please refer to Figure 1.

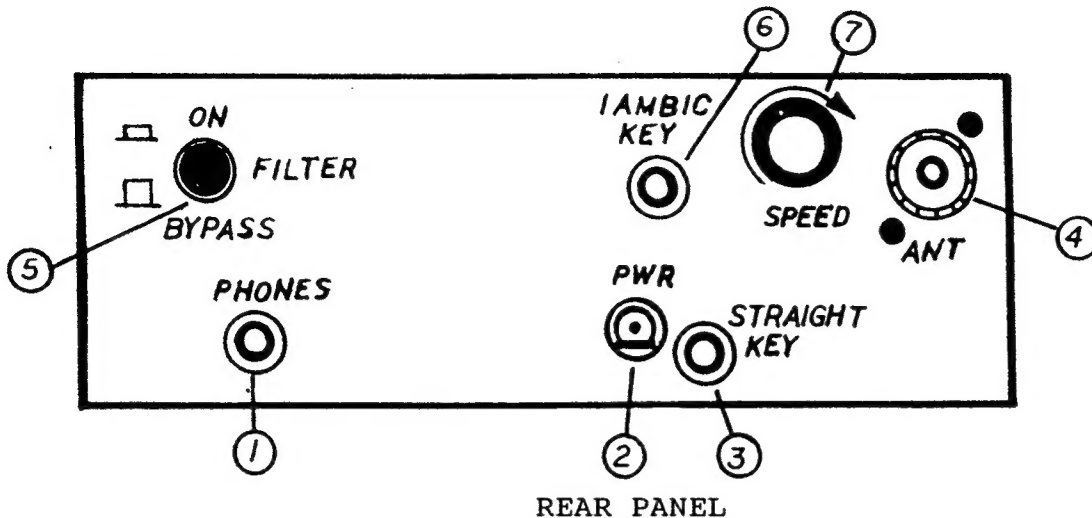
The MFJ-9020 receiver is a single-conversion superhet. Received signals are pre-selected by 4-pole bandpass filter at L1-L2, then amplified and converted to 10-MHz by double-balanced mixer U1. The required 4-MHz VFO signal is generated by U1's internal oscillator section. A varactor RIT circuit (switched at Q2) provides adjustable VFO shift on receive only. The output of mixer U1 is filtered to CW message-channel bandwidth by crystal ladder filter Y1-Y4. Q10 is a FET IF-filter post-amp which provides initial IF gain and establishes a low front-end noise figure for U2. U2 provides IF amplification and gain control. In receive mode, audio-derived AGC maintains constant signal output. During transmit, Q10 is disabled to reduce gain -- but all other receiver stages remain on to generate sidetone. The receiver returns to full gain instantly when Q10 is re-powered.

DBM Product Detector U3 provides audio recovery and gain. A 10-MHz VXO circuit at U3 generates BFO injection. U3 output passes through a pi-section RC filter to reduce wide-band noise. The optional MFJ-726 NARROW AUDIO FILTER may be inserted at this point to provide a restricted audio passband centered at 700 Hz. Audio Amplifier U4 is configured for full gain to develop AGC feedback at all volume settings. The feedback signal is rectified and amplified through DC amplifiers Q3/Q4 (AGC drive and hang time are set at Q3, and Q4 sets AGC bias for U2). The receiver's volume control is an adjustable attenuator positioned between the output of U4 and the speaker.

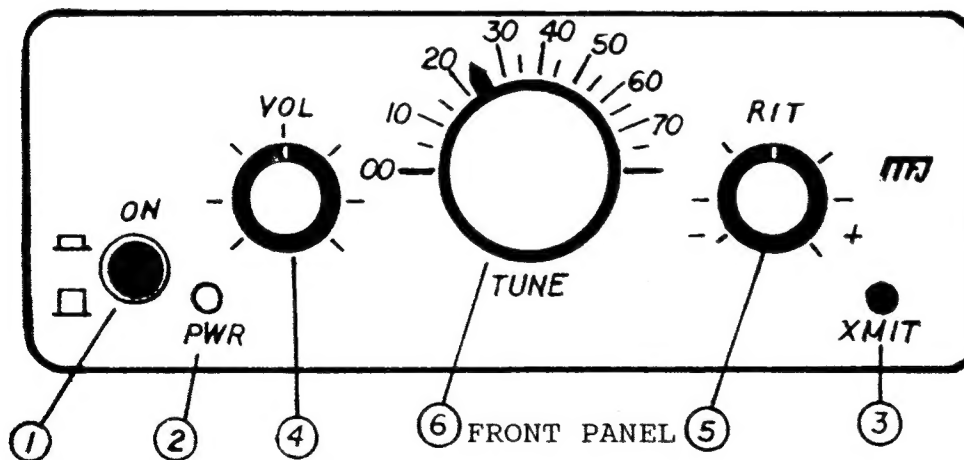
To transmit, DC switch Q5 keys TX Mixer U5 and turns on Relay Driver Q6 -- closing T/R relay K1. K1, in turn, switches the antenna and routes unregulated Vcc to Q7-Q9, a TX LED, Q2, and the AGC clamping circuit. RC circuitry at Q6 sets QSK hold. U5 mixes the 4-MHz VFO signal with a 10-MHz Transmit Oscillator signal to produce 14-MHz CW. Buffer Q1 isolates the VFO and sets injection level to U5. The Transmit Oscillator VXO offsets the BFO by 700 Hz -- providing automatic CW offset and enabling the receiver to generate a pure 700-Hz sinewave sidetone. A four-pole bandpass filter at L6-L7 attenuates unwanted mixer products, and follower Q7 matches the high-Q filter to driver Q8. Q8, operating in class AB, excites class C PA stage Q9 through matching transformer T3. T4 matches the output of Q9 into a 50-Ohm 1/2-wave filter which suppresses harmonics and other unwanted transmitter products.

Operating voltage to small-signal stages is regulated at 10.5 VDC by U6. This provides a regulation threshold of approximately 11.75 volts to facilitate 12-Volt battery operation. Individual LM78L05's clamp U1 and U5 at 5 volts Vcc.

MFJ-9020 CONTROL LOCATION AND FUNCTION:



1. PHONE JACK: 3.5mm mono jack for low-Z phones or ext. speaker.
2. POWER JACK: 5.5mm OD, 2.1mm ID coaxial, (+) to center pin.
3. KEY JACK: 3.5mm mono jack for handkey (or most keyers).
4. ANTENNA JACK: SO-239 for standard coax plugs.
5. CW FILTER SWITCH: Activates MFJ-726 narrow audio CW filter.
6. IAMBIC KEYSER JACK: 3.5mm stereo jack for iambic keyer paddles.
7. KEYSER SPEED: Sets sending speed of MFJ-412 Iambic Keyer.



1. POWER SWITCH: Turns power on to the transceiver.
2. "PWR" LED: Indicates when radio turned is on.
3. "XMIT" LED: Indicates when radio is transmitting.
4. VOLUME: Adjusts speaker or headphone volume level.
5. RIT: Shifts receiver frequency.
6. VFO TUNE: Selects transceiver operating frequency.

## SETTING UP YOUR MFJ-9020 QRP STATION:

To put the MFJ-9020 on the air, you'll need a power source, a 20-Meter antenna, and a key (headphones optional).

### 1. POWER SOURCE: 12-15 V @ 1.2 A, (+) TO CENTER PIN

The MFJ-4114 RECHARGING AC/BATTERY PACK SUPPLY and MFJ-4110 COMPACT AC WALL ADAPTER SUPPLY are especially designed for the MFJ-9020. However, you may use any well-filtered 12-15 volt 1.2 amp source (sources under 12 volts are insufficient to operate the transceiver's voltage regulator and should be avoided). A full 13.8 volts is required to achieve full RF output. The power connector at the rear of your MFJ-9020 is a 5.5mm OD, 2.1mm ID coaxial type jack. Extra plugs are available from local Radio Shack stores under part number 274-1567. Make sure you connect the plus (+) lead to the CENTER PIN of the transceiver power plug. For portable operation, install NiCd D-cells in your MFJ-4114 power pack or connect a 12-15 volt battery directly to the MFJ-9020 power jack. Replace or recharge when key clicks appear on the sidetone (your first indication that battery voltage is falling below the transceiver's voltage regulator threshold).

### 2. KEY/KEYER: ACCEPTS MOST TYPES -- USE 3.5mm MONO PLUG

The MFJ-9020 hi-Z keying circuit operates with mechanical keys, relay-output keyers, and most electronic keyers. The "straight-key" jack accepts a standard 3.5mm monaural miniplug. If you wish to plug paddles directly into the radio, install the optional MFJ-412 CURTIS IAMBIC KEYS MODULE (this accepts a 3.5mm stereo miniplug). You may continue to use a straight-key in normal fashion with the keyer module installed.

### 3. ANTENNA: VSWR 3:1 OR LESS IN CW BAND

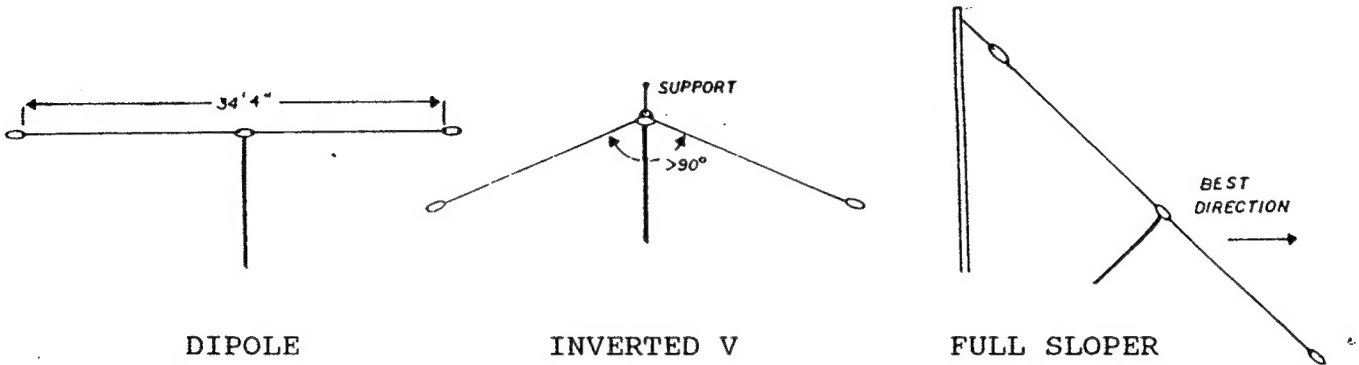
The MFJ-9020 is tolerant of reactive loads, and accepts virtually any 20-Meter antenna with a VSWR of 3:1 or less. To get on the air, hook your regular station antenna to the transceiver's SO-239 connector -- or install a dedicated 20-Meter CW-band dipole such as the MFJ-1772. For non-resonant wire antennas, use a tuner such as the MFJ-971 which features a user-selectable 6-watt SWR range for QRP operation. Avoid operating into unmatched high-SWR antennas. This could result in transmitter instability and the generation of out-of-band spurious signals in violation of FCC rules. For specific QRP antenna suggestions, see "QRP Operating Tips" and "Simple 20-Meter Antennas".

### 4. HEADPHONES: 8-16 Ohm is Best.

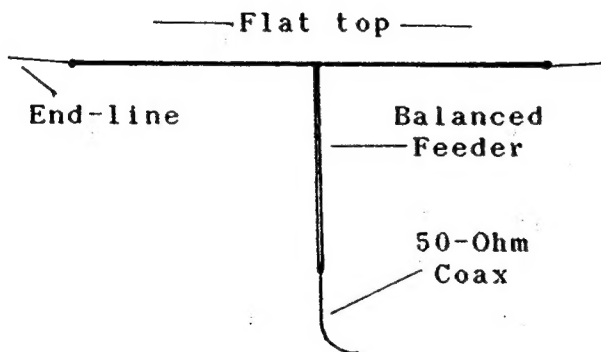
If you use phones, consider purchasing a low-Z monaural set like the Radio Shack #20-210 communications headset.

## SIMPLE 20-METER ANTENNA SUGGESTIONS:

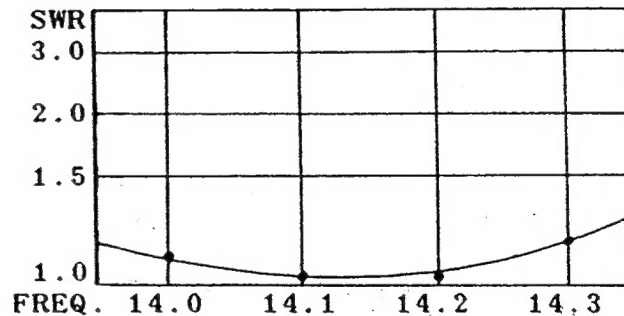
**COAXIAL-FED DIPOLES:** A CW-band wire dipole should measure about 34'4" (17'2"/leg). Feed with RG-58U or RG-8X; raise high and in the clear for best DX coverage. If you have only one high support, make an inverted V. The "full sloper" (sloping dipole) is also an excellent single-support antenna with directivity.



**MFJ-1772 PORTABLE DIPOLE:** As an alternative to making a coax-fed dipole, consider purchasing the pre-assembled MFJ-1772 antenna. This is a no-compromise 20-Meter folded dipole complete with 30' of feedline -- all made from light-weight 300-Ohm twinlead. Connect a random length of coax from the MFJ-1772 feedline to your rig and let the antenna's built-in 50-Ohm matching network do the rest. The antenna is pre-tuned, easy to handle, and very broad-banded!



MFJ 1772 DIPOLE



TYPICAL SWR CURVE

**WARNING:** CONSTRUCTING OR ERECTING AMATEUR RADIO ANTENNAS IN LOCATIONS WHERE THEY MAY COME INTO CONTACT WITH ELECTRICAL POWER LINES MAY RESULT IN ACCIDENTAL INJURY OR DEATH!



## GETTING THE MOST FROM YOUR QRP STATION:

Spanning the globe with less power than it takes to light a Christmas-tree bulb is not only exciting, it borders on the miraculous. Yet, despite the vast distances involved, 20-meter QRP enthusiasts consistently reach every corner of the planet -- sometimes running only microwatts! How do they do it? Here are some proven tips to help you work great DX with your MFJ-9020:

### GROOM YOUR ANTENNA:

Inspect and clean all traps and contacting surfaces on triband beams. Replace corroded hardware, dirty connectors, and aging coax. Retune for minimum SWR in the CW band.

Raise wire dipoles high and in the clear -- 30 to 60 feet is far superior to 10 or 20. Carefully prune for minimum SWR. If you have only one high support, install an inverted V or sloper.

Multiband verticals (1/4-wave types) require at least 4 good 14-MHZ radials -- add them if needed. Clean up corrosion and adjust the top section for minimum SWR in the CW band.

Avoid "compromise" antennas whenever possible. Every dB of efficiency gained at the antenna will pay off in operating fun!

### USE PROVEN DX OPERATING TECHNIQUES:

Be a good listener. Searching out and answering CQ's yields more contacts than repeatedly calling CQ.

When you DO call CQ, try signing "/QRP" at least once so stations will know you are running low power.

Never hesitate to call a weak DX station. They may be running low power or using a marginal antenna. You may be loud!

Be persistent. You may have to wait until the "big guns" make contact and move on. It pays to hang around.

Look before you leap. Wait for a momentary lull in the pile-up, then quickly slip in your call.

Call up or down frequency. Set the RIT control fully (+) or (-) and retune your station. You'll transmit off-frequency, allowing you to sidestep the middle of the pileup.

Let DX stations know you are QRP by signing "/QRP" at the end of your call. If they hear "QRP", they may ask others to stand by.

Pay attention to DX forecasts and gray-line propagation. When the band is hot, power difference become much less significant.



## FIELD DAY AND OTHER "DX-PEDITION" OPERATING HINTS:

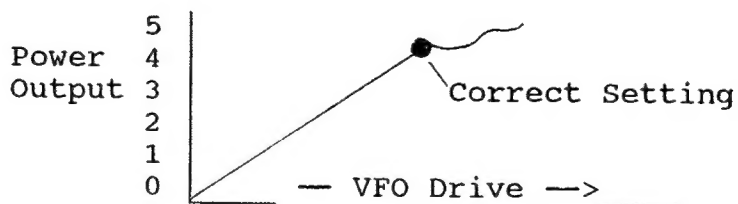
The MFJ-9020 is rugged, but you may want to consider your radio's limitations before you throw it into a backpack and head for Grand Cayman Island.

1. The MFJ-9020 case is an attractive matte-black -- not unlike the surface of a solar collector. For that reason, we recommend confining outdoor operation to shady areas!
2. The MFJ-9020 has no SWR over-protection. It is up to you to prevent the PA-stage from "taking off" into parasitic oscillation by providing a reasonable antenna. This means no bedsprings or barbed-wire fences (at least without a tuner).
3. Romps on sandy beaches and white-water canoe rides are great fun for humans, but not healthy for radios. Sealing your MFJ-9020 in a plastic bag before exposing it to environmental hazards.

## QRPp (ULTRA-LOW POWER) OPERATION:

You may adjust your MFJ-9020 for any power level down to zero. However, PLEASE DO NOT ATTEMPT THIS PROCEDURE IF YOU DO NOT FEEL COMPETENT TO MAKE TECHNICAL ADJUSTMENTS ON MANUFACTURED RADIO EQUIPMENT. You'll need a QRP wattmeter, dummy load, and a well-regulated 13.8 V power supply.

1. TO REDUCE POWER: Locate VFO trimpot behind the volume control (see Field Service diagram for exact location). Key radio and monitor power on a QRP wattmeter. Turn the VFO trimpot counter-clockwise (CCW) to set the desired RF power output level.
2. TO RESTORE FULL POWER: Connect QRP wattmeter and dummy load to rig. Confirm supply voltage is 13.8 volts. Set VFO trimpot fully counter-clockwise (CCW). Key rig and advance VFO trimpot clockwise (CW). Output should increase smoothly and rapidly. At 4 - 4.5 Watts, output will increase less rapidly and reach a "plateau". Move trimpot setting back and forth to locate exact point where the plateau first appears. See page 11 "Transmit Mixer Level" for more information.



WARNING: NEVER SET VFO TRIMPOT FOR THE "MAXIMUM POWER OUTPUT OBTAINABLE" OR IN EXCESS OF 5 WATTS OUTPUT. MFJ ENTERPRISES, INC. CANNOT ASSUME RESPONSIBILITY FOR THE PERFORMANCE OF ANY TRANSMITTER THAT HAS BEEN ADJUSTED OR MODIFIED IN THE FIELD.

## IN CASE OF TROUBLE:

CHECK IT OUT FIRST, THEN CALL 800 647-TECH (800 647-8324). Your MFJ-9020 is backed for one full year by MFJ's unconditional "NO MATTER WHAT GUARANTEE". This means MFJ will repair or replace ANYTHING that goes wrong with your radio for the first year -- no matter what! And, MFJ Customer Service Technicians will be there to help you keep your rig in top shape for as long as you own it. However, before you call the factory with a problem, we ask that you check through this list of common problems first -- just to make sure it isn't something simple you can fix yourself!

### 1. RADIO WILL NOT POWER UP:

Check Power Plug -- is it loose? Broken supply wire?

Check Power Source -- is it providing output?

Check polarity protection fuse -- thin pc track fuse opens when (+) and (-) leads are reversed (see page 12 for location).

### 2. NO SIGNALS RECEIVED:

Check Antenna -- disconnected? Broken or shorted leads?

Check Propagation -- geomagnetic storm? Dead band?

### 3. NO AUDIO:

Check Phone Jack -- is plug inserted defeating the speaker?

Check Headphones -- broken wire or shorted plug?

### 4. WON'T TRANSMIT, KEYS ERRATICALLY:

Check Key Plug or Keyer -- is key making contact? Broken wire?

Check Power source -- is it powerful enough to operate radio?

### 5. KEY CLICKS ON SIDETONE, LOUD SIDETONE:

Check Power Source -- is it at least 12V under full load?

### 6. ERRATIC OPERATION ON TRANSMIT:

Check SWR -- is antenna mis-adjusted or damaged?

### 7. RECEIVER INSENSITIVE OR AGC INEFFECTIVE:

Check TP-1, set AGC pot for 4.3 V reading (no signal).

### 8. RECEIVER INSENSITIVE, VOLUME LOW:

Check TP-2, set REG pot for 10 volts.

### 9. EXCESSIVE VFO DRIFT:

Check Temperature -- is case in Sun or on a warm surface?

### 10. SIDETONE HIGH OR LOW IN FREQUENCY:

Check TX FREQ trimmer, readjust for a 700-Hz tone in speaker.

If these checks don't uncover the problem, or if you don't feel qualified to make the prescribed adjustments, please call us for help at 800 647-TECH (800 647-8324).

## FIELD ALIGNMENT PROCEDURES FOR THE MFJ-9020 TRANSCEIVER:

### SPECIAL TOOLS, PARTS, TEST EQUIPMENT:

1. AC Power Supply, 13.8 Volts @ 1.5 Amps
2. Sensitive Voltmeter (DVM or Analog)
3. Non-inductive Alignment Tool kit
4. Frequency Counter
5. QRP Wattmeter with 50-Ohm Resistive Dummy Load
6. 14-MHZ Signal Generator or Weak Signal Source
7. (Optional) General Coverage Receiver -- Digital Readout

### INITIAL TEST SET-UP: (see diagram on page 12)

- A. Remove transceiver cover.
- B. Connect 13.8 Volts Power Supply to Power Jack.
- C. Connect Key to Jack.
- D. Remove CW Filter and Keyer modules if installed.
- E. Install shorting clip on pins 2 and 3 of CW Filter Header.
- F. Turn on unit.

### VOLTAGE CHECKS AND ADJUSTMENTS: (use voltmeter)

- A. VOLTAGE REGULATOR: 10 V at TP2, adj. REG trimpot.
- B. RECEIVER AGC: 4.3 Volts at TP1, adj AGC trimpot.
- C. RIT: Approx 5.3 Volts at TP3 when RIT knob at 12:00.

### VFO CALIBRATION: (use counter or digital\_readout receiver)

- A. Tune VFO dial to 14.025.
- B. Place freq. counter probe near (but not on) ant jack.
- C. Key radio and adjust VFO CAL (L3) for 14.025 MHZ.

### BFO FREQUENCY CHECK AND ALIGNMENT:

- A. Connect Voltmeter to TP1 to read AGC voltage.
- B. Connect Frequency Counter to speaker output.
- C. Apply 14 MHZ signal source to antenna jack (mid-band).
- D. Tune in signal for maximum reading at TP1.
- E. Adjust Volume for a stable counter reading.

NOTE: Best performance occurs when maximum AGC voltage at TP1 coincides with 700 Hz audio output. If maximum AGC occurs when CW tone is significantly above or below 700 Hz, adjustment is required. If okay, skip BFO alignment and move on.

- F. Reset BFO Trimcap until Voltmeter peak coincides with 700 Hz tone.
- G. To check suppression of opposite sideband -- tune through zero beat. Little or no signal should be audible on the low side. If suppression is poor, increase BFO freq. slightly (200 Hz) and recheck.
- H. Confirm BFO is on correct sideband -- CW note must increase in pitch as you tune upward in frequency.

NOTE: If BFO is on wrong sideband, experimentally reset the BFO trimcap until tuning up in frequency causes the CW note to increase in pitch. Now, repeat the BFO procedure described above.

TRANSMITTER OSCILLATOR OFFSET (SIDETONE) ADJUST:

- A. Connect dummy load to antenna jack.
- B. Connect frequency counter to speaker output.
- C. Key transmitter, adjust TX FREQ trimcap for 700 Hz sidetone note.

RECEIVER SENSITIVITY CHECK:

- A. Connect 14.025 MHz weak signal source to antenna jack.
- B. Connect voltmeter to TP1 (AGC voltage)
- C. Tune in signal source for maximum AGC indication.
- D. Carefully touch up RX1, RX2, IF1, IF2 for max SIG Meter reading.

TRANSMITTER BANDPASS FILTER ALIGNMENT:

- A. Connect QRP Wattmeter with dummy load to ANT Jack.
- B. Key transmitter, adjust VFO trimpot CCW for <3-W Po.
- C. Carefully touch up TX1 and TX2 for peak output.

TRANSMIT MIXER LEVEL:

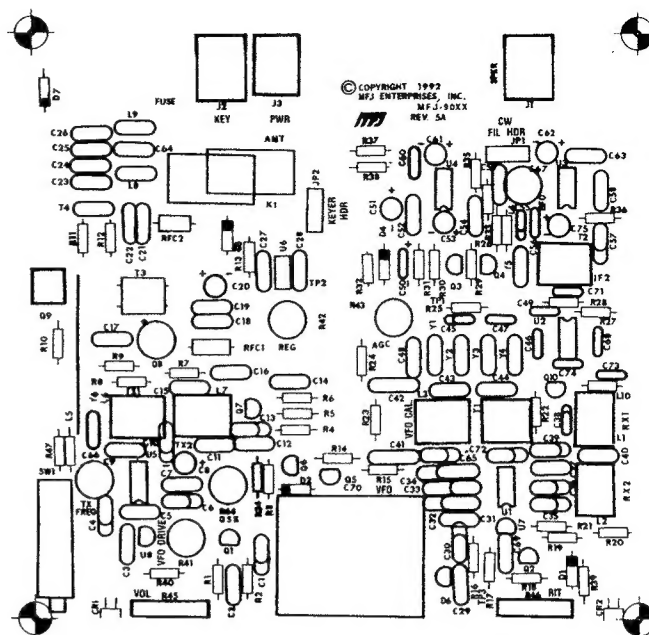
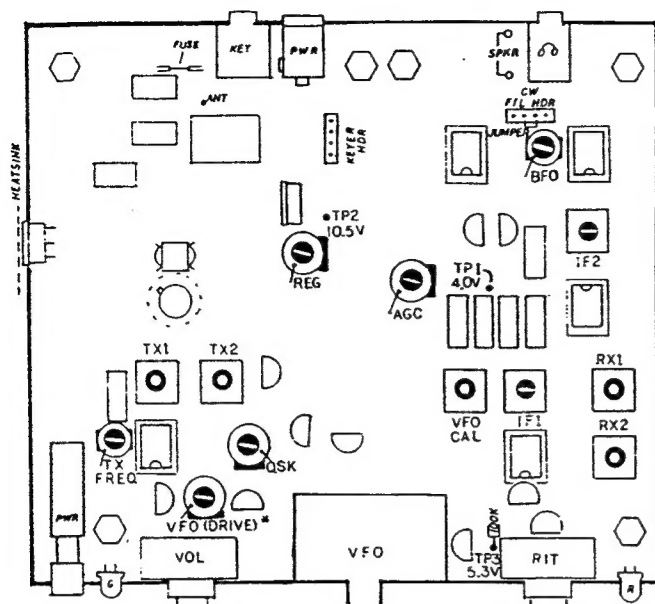
- A. Turn VFO Trimpot fully CCW. Key rig.
- B. Advance VFO Trimpot CW while watching RF output level. RF output should increase rapidly. Continue CW until output power no longer increases rapidly. Back off slightly, to where output just starts to drop rapidly. This point is typically at 4.5-5.0 watts output.

CAUTION: On some radios, turning the VFO Trimpot fully CW may show some increase in RF output. However, most of this "added power" will be spurious out-of-band energy generated by the overdriven transmitter mixer. Mixer drive MUST be set as outlined above -- or with the aid of a lab-quality spectrum analyzer -- for the MFJ-9020 transmitter to comply with FCC Standards.

NOTE: The FCC requires HF QRP transmitters to exhibit at least 30 dB suppression of unwanted harmonics and spurious products. A properly adjusted MFJ-9020 will easily exceed this specification.

This completes field alignment of the MFJ-9020 Transceiver. If your transceiver fails to operate properly following these procedures, please call 800 647-TECH (800 647-8324) for help -- or return the radio to MFJ for authorized service.

# INTERNAL ADJUSTMENT LOCATIONS AND PARTS PLACEMENT, MFJ-9020:



\*If polarity protection fuse is open, repair with a 1.5-A pigtail fuse or 3/4" #32 hairpin jumper.

## DC VOLTAGE CHART - TROUBLESHOOTING GUIDE:

For advanced troubleshooters, the following are typical DC voltages found in the MFJ-9020.

Vcc = 13.8 (Supply Voltage) TP-1 = 4.3 (AGC Bias Voltage)  
 TP-2 = 10.0 (LM-317 Regulated Voltage)  
 TP-3 = 5.3 (Zero shift RIT Voltage)

## INTEGRATED CIRCUITS:

	RX				TX
Pin	U1	U2	U3	U4	U5
1	1.3	9.4	1.3	1.4	1.3
2	1.3	9.4	1.3	0.0	1.3
3	0.0	0.0	0.0	0.0	0.0
4	3.8	3.1	3.8	0.0	3.8
5	3.8	4.6	3.8	6.8	3.8
6	5.0	3.1	5.1	13.5	5.1
7	4.7	0.0	4.7	6.6	4.9
8	5.0	9.4	5.2	1.4	5.0

## BIPOLAR AND JFET DEVICES:

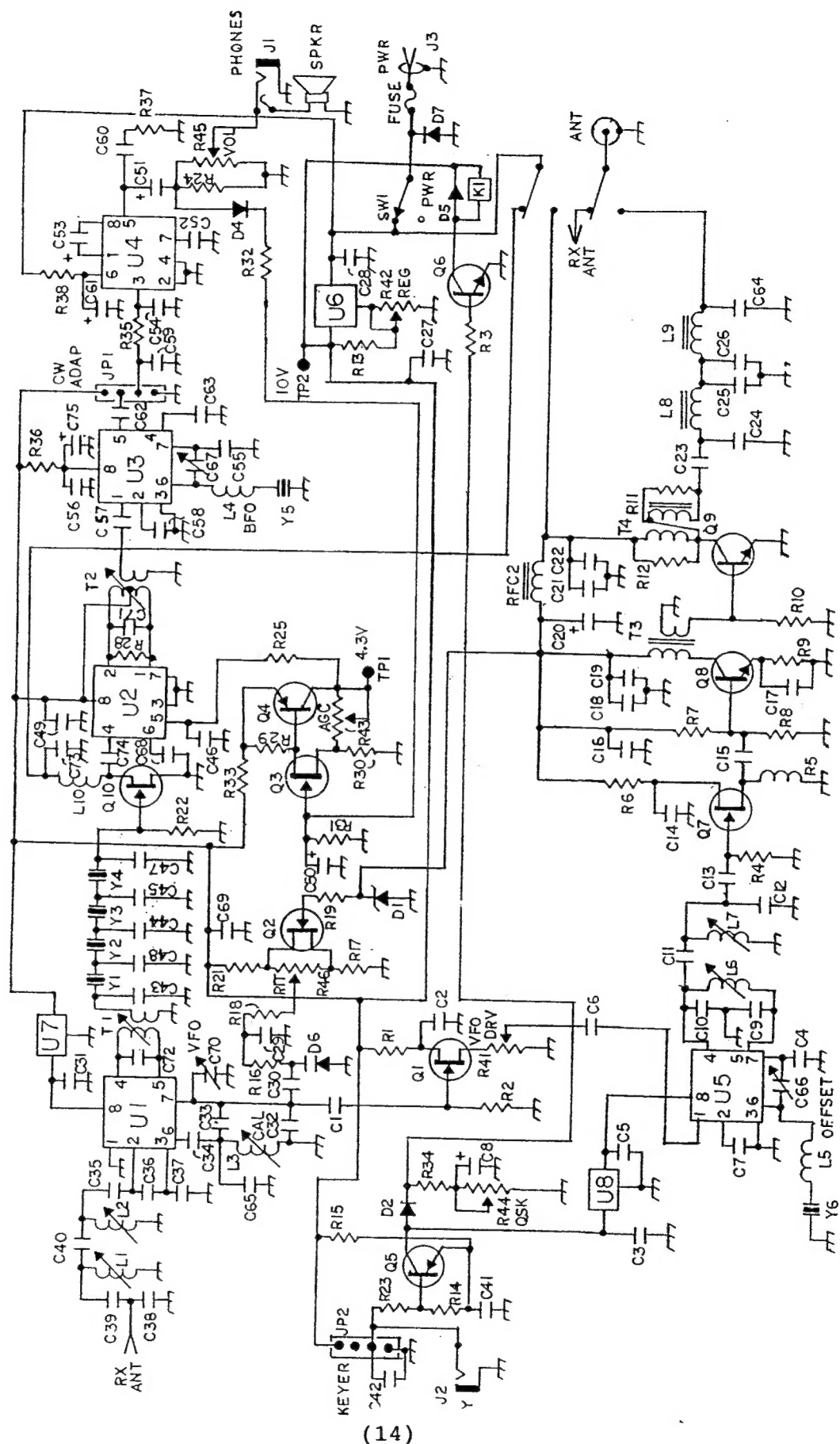
FLAT SIDE D/E = Drain/Emitter  
 D S G S/B = Source/Base  
 BIPOLAR G/C = Gate/Collector

FLAT SIDE  
 E B C  
 JFET

	RX						TX		
	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9
D/E	10.2	3.6	9.6	10.1	10.4	----	12.7	.14	----
S/B	1.8	6.8	2.8	9.4	10.3	----	1.9	.8	----
G/C	----	----	----	4.0	----	13.3	----	13.5	13.5

## MFJ-9020 Parts List

DESIGNATION	DESCRIPTION	MFJ PARTS #	DESIGNATION	DESCRIPTION	MFJ PARTS #
C1	22pF, 50V Multilayer	205-0022	K1	12V Relay	408-2035
C2,14,17,19,21,23,27,28	.1uF, 50/100V Disc	205-0005	L1,2,6,7	1.5uH, Red Inductor	402-3402
C31,49,52,56,58,60,68,69	.1uF, 50/100V Disc	205-0005	L3	6.5uH Inductor	402-3406
C3,5,7,16,37,41,42,46	.01uF, 25/50V Disc	200-0004	L4,5	15uH, Inductor	401-0043
C63,73	.01uF, 25/50V Disc	200-0004	L8,9	12T Inductor	10-10120
C4	47pF, 50V Multilayer	205-0021	L10	47uH Inductor	401-0076
C6	100pF, 50V Disc	200-0003	Q1,2,3,7,10	2N5486	305-6004
C8	22uF, 16V Electrolytic	203-0013	Q4,5	2N3906	305-0002
C9,10	180pF, 50V Multilayer	205-0180	Q6	2N3904	305-0001
C11,40	4.7pF, 50V Disc	200-0012	Q8	2N5109	305-0017
C12	68pF, 500V Disc	200-1009	Q9	MRF-476	305-5476
C13,36,74	100pF, 50V Multilayer	205-0100	R1,10,13,15,24,33	100 ohm, 1/4 Watt	100-0003
C15,18,22,29	0.001uF, 1KV Disc	200-2024	R2,4,14,16	100K ohm, 1/4 Watt	100-0029
C20,53,75	10uF, 35V Electrolytic	203-0012	R3,17,21,25,28,29,32	10K ohm, 1/4 Watt	100-0017
C24,25,26,64	220pF, 500V SM	208-0220	R5	27uH, Inductor	401-0078
C30	10pF, 50V Multilayer	205-0010	R6	270 ohm, 1/4 Watt	100-0007
C32,33,45,48	470pF, 50V Multilayer	205-0470	R7,23,35	4.7K ohm, 1/4 Watt	100-0014
C34	.1uF, 50V Multilayer	205-2210	R8	470 ohm, 1/4 Watt	100-0009
C35	560pF, 50V Multilayer	205-0560	R9	10 ohm, 1/4 Watt	100-0002
C38	680pF, 50V Multilayer	205-0680	R11,12	220 ohm, 1/4 Watt	100-0005
C39	100pF, Polystyrene	202-0017	R18,19	47K ohm, 1/4 Watt	100-0023
C43,47	330pF, 500V Disc	200-1006	R20,30,34	1K ohm, 1/4 Watt	100-0010
C44	560pF, 500V Disc	200-1560	R22	330 ohm, 1/4 Watt	100-0074
C50	2.2uF, 16V Tan.	203-8022	R31	1M ohm, 1/4 Watt	100-0040
C51,61	100uF, 16V Electrolytic	203-0003	R36,39,40	2.2K ohm, 1/4 Watt	100-0012
C54,59	.047uF, 50V Disc	200-0031	R37	15 ohm, 1/4 Watt	100-0075
C55	47pF, 50V Disc	205-1002	R38	22 ohm, 1/4 Watt	100-0112
C57	0.001uF, 50V Multilayer	205-1010	R41,42,43	1K ohm, Trimpot	104-4001
C62	2.2uF, 35V Electrolytic	203-0002	R44	100K ohm, Trimpot	104-4004
C65	68pF, 50V Multilayer	205-0068	R45	250 ohm, Pot	105-0007
C66,67	12-100pF, 250V Trimmer	204-0010	R46	10K ohm, Pot	105-0002
C70	5-50pF, 750V Tuning Cap	204-5050	RFC2	4.7uH Inductor	401-0099
C71,72	6.8pF, 500V Disc	200-1013	SW1	Switch	504-0022
CR1	MV5753 Red LED	320-0001	T1,2	25K:1K Inductor	402-3123
CR2	Green LED	320-0002	T3	3:1 Transformer	10-10090
D1	1N5235B	301-5235	T4	8T Toroid	10-10040
D2,4,5	1N4148	300-0003	U1,3,5	NE602	311-1602
D6	MV2104	315-2104	U2	MC1350P	311-1045
D7	1N4001	300-1004	U4	LM386	311-0386
J1,2	3.5mm Stereo	601-5003	U6	LM317T	307-1021
J3	2.1mm Coaxial	601-6021	U7,8	78L05AC	307-0010
JP1,2	4 Pin Header	612-0014	Y1,2,3,4,5,6	10MHz Crystals	405-0065



SCHEMATIC DIAGRAM, MFJ-9020



## FULL 12 MONTH WARRANTY

MFJ Enterprises, Inc. warrants to the original owner of this product, if manufactured by MFJ Enterprises, Inc. and purchased from an authorized dealer or directly from MFJ Enterprises, Inc. to be free from defects in material and workmanship for a period of 12 months from date of purchase provided the following terms of this warranty are satisfied.

1. The purchaser must retain the dated proof-of-purchase (bill of sale, canceled check, credit card or money order receipt, etc.) describing the product to establish the validity of the warranty claim and submit the original or machine reproduction or such proof of purchase to MFJ Enterprises, Inc. at the time of warranty service. MFJ Enterprises, Inc. shall have the discretion to deny warranty without dated proof-of-purchase. Any evidence of alteration, erasure, or forgery shall be cause to void any and all warranty terms immediately.
2. MFJ Enterprises, Inc. agrees to repair or replace at MFJ's option without charge to the original owner any defective product provided the product is returned postage prepaid to MFJ Enterprises, Inc. with a personal check, cashiers check, or money order for **\$7.00** covering postage and handling.
3. MFJ Enterprises, Inc. will supply replacement parts free of charge for any MFJ product under warranty upon request. A dated proof of purchase and a **\$5.00** personal check, cashiers check, or money order must be provided to cover postage and handling.
4. This warranty is **NOT** void for owners who attempt to repair defective units. Technical consultation is available by calling (601) 323-5869.
5. This warranty does not apply to kits sold by or manufactured by MFJ Enterprises, Inc.
6. Wired and tested PC board products are covered by this warranty provided **only the wired and tested PC board product is returned**. Wired and tested PC boards installed in the owner's cabinet or connected to switches, jacks, or cables, etc. sent to MFJ Enterprises, Inc. will be returned at the owner's expense unrepaid.
7. Under no circumstances is MFJ Enterprises, Inc. liable for consequential damages to person or property by the use of any MFJ products.
8. **Out-of-Warranty Service:** MFJ Enterprises, Inc. will repair any out-of-warranty product provided the unit is shipped prepaid. All repaired units will be shipped COD to the owner. Repair charges will be added to the COD fee unless other arrangements are made.
9. This warranty is given in lieu of any other warranty expressed or implied.
10. MFJ Enterprises, Inc. reserves the right to make changes or improvements in design or manufacture without incurring any obligation to install such changes upon any of the products previously manufactured.
11. All MFJ products to be serviced in-warranty or out-of-warranty should be addressed to **MFJ Enterprises, Inc., 921A Louisville Road, Starkville, Mississippi 39759, USA** and must be accompanied by a letter describing the problem in detail along with a copy of your dated proof-of-purchase.
12. This warranty gives you specific rights, and you may also have other rights which vary from state to state.